

Synchrotron Characterization of Advanced Non-planar, Non-Si Logic Device Film Systems

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Before the year 2000, even the most novel high performance CMOS devices used only 15 elements from the periodic table. That number has since tripled in the past decade as the semiconductor industry struggles to keep up with the pace of Moore's Law and circumvent certain roadblocks associated with the device dimensions reaching their physical scaling limits. This paradigm – an industry wide focus relying on material science – has also heralded a need for atomically precise characterization techniques to replace existing lab-based methods that are reaching their own precision and accuracy limits. In this talk, specific examples will be presented where results obtained on different NSLS beam lines helped guide the semiconductor industry's understanding of how the introduction of new materials interact with existing CMOS processes, and how such interactions correlate with device performance and reliability metrics. The presentation will highlight the benefits of using synchrotron X-Ray photo-emission and absorption to characterize novel dielectric thin films and high mobility III-V substrates. In each case, we will try to identify the spectroscopic limitations of the experiment in order to provide a basis for discussing how NSLS II can help bridge this gap.